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Yield assessment of finger millet (*Eleusine coracana* L.) variety *Arjun* in Ganjam district, Odisha, India

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ABSTRACT

Finger millet (*Eleusine coracana* L.), commonly known as ragi has a wide ecological and geographical adaptability and resilience to various agro-climatic adversities. It requires low external input and highly suitable for drought conditions and marginal lands. Front line demonstration of ragi variety *Arjun* was conducted at two villages Kusumi and Bagalati of Kukudakhandi block of Ganjam district with 10 farmers in cluster approach system during *kharif* 2023 and 2024. The final seed yield was recorded after harvest, and the gross return was calculated based on the prevailing market price. The results proved that demonstration of the finger millet variety *Arjun* (OEB-526) recorded an average yield of 17.6 q ha^{-1}, compared to farmers variety *Budha Mandia* 11.68 q ha^{-1}. The finger millet variety *Arjun*, when cultivated with proper nutrient application and plant protection measures, produced 51% higher yield compared to traditional farming practices. Thus, the local finger millet variety can be substituted by high yielding variety *Arjun* which can increase the income level of farmers and improve their livelihood conditions.

Key words: Drought, finger millet, frontline demonstration, yield

INTRODUCTION

"Millet" is a collective term referring to small seeded annual grasses grown primarily as grain crops on marginal lands in arid regions of temperate, subtropical, and tropical climates (Baker, 1996). Finger millet (*Eleusine coracana* L.), commonly known as *Ragi* is an important crop in the tribal regions of Odisha, serving as the staple food for the local population (Mohanty, 2020). This crop originated approximately 5,000 years ago in East Africa, likely in Ethiopia, and was introduced to India around 3,000 years ago (Upadhyaya et al., 2006). It is highly suited to drought conditions suitable for marginal lands and requires low external inputs for cultivation. Nutritionally, finger millet is superior to major cereals and rich source of micronutrients such as calcium, phosphorus, magnesium, and iron (Gull et al., 2014; Chandra et al., 2016; Vadivoo and Joseph, 1998). The grains also contain higher levels of proteins, oils, and minerals compared to rice, maize or sorghum (Reed et al., 1976; Ravindran, 1991, 1992; Vadivoo and Joseph, 1998). With protein (6-8%) and fat (1-2%,) it is comparable to rice whereas with respect to mineral and micronutrient contents it is superior to rice and wheat (Babu et al., 1987; Joshi and Katoch, 1990; Ravindran, 1991, 1992).

Cysteine, tyrosine, tryptophan, and methionine are the amino acids found in finger millet protein (Rachie, 1975). It is also known for several health benefits such as anti-diabetic, anti-tumorigenic, atherosclerogenic effects, and antioxidant properties which are mainly attributed due to its polyphenol and dietary fibre content (Kande et al., 2019). Being indigenous minor millet, it is used in the preparation of various foods both in natural and malted forms. Grains of this millet are processed into flours for preparation of products like porridge, pudding, pancakes, biscuits, roti, bread, noodles and other snacks (Gupta et al., 2017). Besides this, it is also used as nourishing food for infants when malted and is regarded as wholesome food for diabetes patients. Growing of traditional food crops in areas need to be undertaken for sustaining household food security.

Keeping in view of such popularity of finger millet, KVK Ganjam-II, Berhampur made an attempt to evaluate the growth and yield parameters of the promising high-yielding finger millet including it's productivity and studied its suitability in the existing farming situation for substitution of old variety, *Budha Mandia.*

MATERIALS AND METHODS

The study was conducted through frontline demonstration during the *kharif* seasons of 2023 and 2024 in Kusumi, Bagalati village of Kukudakhandi block of Ganjam district in the east and southeastern coastal plain zone of Odisha state with an objective to evaluate the performance of the high-yielding finger millet variety *Arjun*. The experimental site was situated at 19° 16′ 17.626″ N latitude and 84° 44′ 13.326″ E longitude, with an average elevation of 26 meters above sea level. The region experiences a specific climate, with average rainfall of 1276.2 mm during the study period (June to September). The mean maximum and minimum temperatures were 39°C and 18.9°C, respectively. The soil of the experimental site is slightly acidic in reaction (pH, 5.6), sandy loam texture with organic carbon content 0.46%, low in nitrogen 142.5 kg ha^{-1}, low in phosphorus 14.1 kg ha^{-1}, and medium in potassium 151.4 kg ha^{-1} contents. The tested high-yielding variety *Arjun* (OEB-526) is having maturity duration of 110 days and potential yield of 20.7 q ha^{-1} with moderate resistance to leaf, neck, and finger blasts and brown spots. Local variety *Budha Mandia*, the traditional popular variety, is of 105 days duration and drought tolerant trait was taken as the local check.

The field observations were taken from demonstration plot and farmers plot as well. Parameters, like plant height, the number of fingers per plant, finger length, the number of fingers per ear, 1000-seed weight, and seed yield were recorded at maturity stage and the gross returns (Rs. ha^{-1}) were calculated based on the prevailing market prices of the produce. Harvest index is the relationship between economic yield and biological yield (Gardner et al., 1985). It was calculated by using the following formula.

$$\text{Harvest index (\%)} = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

RESULTS AND DISCUSSION

Frontline demonstrations are undertaken to assess the yield potential of a technology in farmers fields. In the study, both *Budha Mandia* and *Arjun* varieties were taken in adjacent plots of both villages. *Budha Mandia* was demonstrated with traditional cultivation practices e.g. seed rate (15 kg ha^{-1}), no seed treatment, broadcasting, manual weeding at 45 days after sowing (DAS) with Blanket 45 kg diammonium phosphate (DAP) application per ha whereas in the demonstrated technologies, besides high yielding variety (HYV) *Arjun*, other important cultivation practices like proper seed rate, seed treatment with Azospirillum and phospho solubilizing microorganisms (PSM), line sowing, proper fertilizer and weed managements (Dalei and Nath, 2014) were taken as indicated in Table 1.

Table 1. Comparison between farmers' practice and demonstrated technologies

Sl. No.	Particulars	Farmers practice	Tested technology
1	Variety	*Budha Mandia*	*Arjuna*
2	Seed rate	15 kg ha^{-1}	10 kg ha^{-1}
3	Seed treatment	No seed treatment	Azospirillum and PSM @ 25 g kg^{-1} seed
4	Method of sowing	Broadcasting	Line sowing with spacing 20 × 10 cm
5	Fertilizer application	Use of DAP	NPK 60:20:20 kg ha^{-1}(three splits of nitrogen)
6	Weed management	Manual weeding at 40- 50 DAS.	Pre-emergence application of Oxyfluorfen @ 37.5 g a.i. ha^{-1} + one hand weeding.

The major differences observed between the demonstrated package and farmers' practice were recommended varieties, seed treatment, soil test-based fertilizer application, and weeding. These are the primary cultivation practices for any field crop to get higher yield.

Table 2. Effect of different treatments on growth and yield parameters (pooled data of 2 years)

Treatments	Plant height (cm)	No. of effective tillers per hill	No. of fingers per year	1000 grain wt. (g)	Grain yield (q ha^{-1})
Arjun	84.6	5.0	7.10	3.08	17.6
Budha Mandia	78.9	3.2	4.87	2.47	11.68
SEm (±)	0.36	0.25	0.294	0.065	0.411
CD at 5%	1.2	0.81	0.94	0.21	1.31

Arjun variety was found superior in both vegetative and reproductive components than the local check (Table 2). Number of fingers per year in the demonstrated variety was 45.7% more than the traditional variety. Besides, *Arjun* variety was yielding 17.6 q ha^{-1} in comparison to 11.68 q ha^{-1} in *Budha Mandia*. It showed that the tested variety was yielding about 50% more than the local one. It corroborates the findings of Dash et al. (2021) on finger millet varieties.

Table 3. Economics of the assessed varieties (Average data over 2 years)

Treatments	Cost of cultivation (Rs ha^{-1})	Gross Return (Rs ha^{-1})	Net Return (Rs ha^{-1})	BCR	Harvest index
Arjun	28,400	56,227	27,827	1.9	27.41
Budha Mandia	21,200	37,528	16,328	1.7	19.8

Table 3 revealed the economics of both the technologies tested in farmer's field. Due to the lower yield, the gross return of local variety is Rs.18,699/- less than the demonstrated variety. The BC ratio in the local cultivation practices was only 1.4. The harvest index in the demonstrated practice was 27.41% as compared to the traditional practice of 19.8%.

CONCLUSION

The cultivation of the finger millet variety *Arjun* was proved to be more productive and can substitute the local variety since it fit to the existing farming situation for higher productivity and income. It was well accepted by farmers due to its higher yield and drought tolerance traits.

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